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Integration between the London and New York Stock Exchanges, 1825-1925[1]

Gareth Campbell and Meeghan Rogers
Queen's University Management School
Queen's University Belfast
Belfast
BT7 1NN
gareth.campbell@qub.ac.uk
mrogers15@qub.ac.uk

Abstract

The integration between the London and New York Stock Exchanges is analyzed during the era when they were still developing as asset markets. The domestic securities on both exchanges showed little sustained integration, even when controlling for the different characteristics of stocks, implying that the pricing of securities in the US and UK were still being driven by local factors. However, there was considerable integration between New York and those listings on London which operated internationally. These results place a limit on the view that pre-World War I was the first era of globalization in terms of capital markets, and suggest that the listing of foreign securities may be one of the primary mechanisms driving asset market integration.

[1] We would like to thank John Turner, Alan de Bromhead, the referees and editor for their comments and advice.

1. Introduction

A large body of recent research has argued that the period before World War I was the first era of globalisation, and that there were highly integrated financial markets during this time. O'Rourke and Williamson[2] argue that 'international capital markets were extremely well integrated in the late nineteenth century'. Obstfeld and Taylor[3] suggest that there have been 'two great phases of integration, one before 1914, and one in the contemporary period.' Bordo, Eichengreen and Irwin[4] argue that by some measures the level of financial integration before 1914 remains unsurpassed, but in other respects was not as deep as it is in the modern era. Volosovych[5] and Mauro[6] suggest that bond market integration was high before World War I, but not as high as the modern era. Goetzmann, Li and Rouwenhorst[7] have shown that global equity market correlations immediately prior to World War I were relatively high, being surpassed only briefly during the Great Depression and the late 1990s. Obstfeld and Taylor[8] also find a peak in equity market correlations before 1914. Sylla, Wilson and Wright[9] also argue that 'the integration of trans-Atlantic capital markets began after 1815, far earlier than previously thought by those who consider the period 1870–1914 to be the first era of financial globalization'.

In this paper, we focus on the integration between the London Stock Exchange (LSE) and New York Stock Exchange (NYSE), allowing us to examine not just the level of integration, but more importantly the mechanisms by which it occurred. We are unaware of any other paper which has delineated how and why capital markets integrated in this 'first era of globalisation'.

[2] O'Rourke and Williamson, 'Globalisation and history' p.225
[3] Obstfeld and Taylor, 'Global Capital Markets' p.121
[4] Bordo, Eichengreen and Irwin, 'Was there really'
[5] Volosovych, 'Market integration'
[6] Mauro, 'Emerging market spreads'
[7] Goetzmann, Li and Rouwenhorst, 'Long-term,' p. 21
[8] Obstfeld and Taylor, 'Historical Perspective' p.159
[9] Sylla, Wilson and Wright, 'Trans-Atlantic capital markets', p.636

For much of the period under consideration, London and New York were the two largest stock markets in the world. By the end of our sample period, in the mid-1920s, New York was becoming regarded as the leading financial centre in the world[10]. London was still larger in terms of total equity market capitalisation, but New York was a close second, and they were both much greater than any other market worldwide, as shown by Moore[11], and summarised in Table 1.

<< INSERT TABLE 1>>

Moore[12] has also shown that by 1903 London was clearly the largest equity market in the world, and New York had become firmly established in second place. As shown in Table 1, the total market capitalization of equities on New York was about the same as the next five largest stock exchanges from around the world put together. NYSE had fewer stocks listed than some other exchanges, but Michie notes that 'this reflected a deliberate policy of exclusion, rather than any lack of applications for listings.[13]' New York was particularly discerning in terms of which companies it accepted for listing, focusing on very large firms, which were likely to be heavily traded, as can be seen from the average capitalization figures in Table 1. The lower number of securities actually reflected its premium position, and sophistication.

Qualitative evidence suggests New York was regarded as the leading foreign market by British newspapers in earlier decades as well. By 1885 the 'Foreign Commercial Intelligence' section of *The Times* was dominated by New York, with detailed stock price tables which took up more space than all of the other international exchanges put together. From its very first edition in 1888, the *Financial Times* (then the *London Financial Guide*),

[10] Sobel, 'Big board', p. 220
[11] Moore 'World Financial Markets', Table 4.
[12] Moore 'World Financial Markets', Table 4.
[13] Michie, 'London and New York', p.185

published detailed stock price tables for the 'American Markets'. No such detail or prominence was given to any other stock market apart from London.

For the first half of the sample period, between 1825 and 1875, New York could probably be regarded as being less developed than London, or indeed some other exchanges. However, the inclusion of this earlier period provides us with a benchmark against which we can compare the later period. It allows us to determine if there were substantial differences in integration depending on the level of sophistication of the markets, and whether there was a gradual process of integration.

The period between 1825 and 1925 covered in this paper is also a particularly interesting time to study as there were a number of conditions prevailing which should have promoted integration. In terms of the domestic securities on each exchange, there were close economic links between the economies of the UK and USA. An analysis of patterns in national income between 1830 and 1925 shows that there was a highly significant relationship (t-statistic = 2.95) between UK and USA GDP growth[14]. In addition, the USA was the most important trading partner of the UK throughout almost the entire period. From 1854, when the first data was reported, to at least 1925, the UK imported more from the USA than from any other country[15]. Even if the imports in the earlier period were raw materials, such as cotton, they would often have been transported by railroads, and the production partially financed by banks, both of which were traded on the New York Stock Exchange. There were also stable exchange rates, with the classic gold standard in operation between 1879 and 1913. These links could have led to common exposure to risks and shocks for securities traded in London and New York.

[14] Calculated from data obtained from MeasuringWorth.com. UK GDP data begins in 1830.
[15] Mitchell, 'International Historical Statistics: Europe', p.663

However, our analysis is not limited to these domestic securities. The key message of the paper is that there were numerous possible mechanisms by which integration could have occurred. Integration could have been promoted via foreign investment. During this period there were high levels of capital mobility, with very few restrictions placed on trading assets across borders. Quinn[16] finds that before 1913 financial openness was greater than at any other subsequent period. This led to a large proportion of US securities being owned by European, particularly British, investors. Sylla, Wilson and Wright[17] note that even in 1803/04 nearly half of the US securities outstanding were held by foreigners. In 1873 about 78.6 per cent of the shares in the Illinois Central Railroad were held abroad[18]. In the mid-1890s, 52 per cent of the Pennsylvania Railroad was owned by overseas investors.[19] With British investors holding considerable amounts of American assets, the buying and selling of UK and US shares could have been affected by the same factors. As time progressed, it became increasingly common for US firms to list on the London Stock Exchange. If securities were moving primarily on regional issues, then these foreign listings could have been a mechanism which made the different markets move in similar ways.

Furthermore, there were some assets which were listed simultaneously in both markets. The consistency of pricing of these cross-listed assets could have been affected by the major advances in communication technology during the period, particularly with the laying of the transatlantic telegraph cable in 1866. It took about four weeks for information to travel across the Atlantic in the 1820s and 1830s[20], but this had fallen to about 30 seconds by 1911[21]. Hoag finds that the laying of the telegraph had an immediate impact on the pricing of US securities in both markets, and London quickly incorporated new information from New

[16] Quinn, 'Capital account liberalisation'
[17] Sylla, Wilson and Wright, 'Trans-Atlantic capital markets', p.617
[18] Wilkins, 'Foreign Investment', p.119
[19] Churella, 'Pennsylvania Railroad' p.714
[20] Sylla, Wilson and Wright, 'Trans-Atlantic capital markets', p.633
[21] Michie 'Global Securities Market' p.130

York[22]. This should have ensured there was little information asymmetry between London and New York, and may have promoted integration.

To analyse the extent of integration, and the mechanisms by which it occurred, we have compiled extensive datasets of securities traded on the London and New York Stock Exchanges. We have obtained data on several thousand common stocks, preference shares, and corporate bonds, on a monthly basis over the hundred year period between 1825 and 1925. This allows us to analyse the movements and connections on both markets, in more detail than has ever been attempted before.

Sylla, Wilson and Wright[23] note that there are several ways to measure integration. The narrowest is to look at identical assets which are traded in different markets, as has been done for several assets and time periods for London and New York[24]. This has the advantage of enabling a precise analysis of whether there were differences in how an asset was priced in each market, but the conclusions are limited to just the small subset of securities which were cross-listed. A broader approach, and the method favoured by financial economists in recent years[25], is to look at assets which may have similar characteristics, but which are not the same. This reveals whether the securities in different markets are responding to the same shocks and risk factors as each other. In this vein, Goetzmann, Li and Rouwenhorst[26] have analysed long-run correlations between portfolios of equities in different countries, and Edelstein[27] has conducted a principal-components analysis to determine if there were common factors driving the returns of companies which operated in different countries and

[22] Hoag, 'Atlantic telegraph'
[23] Sylla, Wilson and Wright, 'Trans-Atlantic capital markets'
[24] Neal, 'International Capital Markets,' 'Disintegration,' Michie, 'London and New York,' Hoag, 'Atlantic telegraph', Sylla, Wilson and Wright, 'Trans-Atlantic capital markets' and Garbade and Silber, 'Technology'.
[25] Pukthuanthong and Roll, 'Global market integration,' Bekaert, Hodrick and Zhang, 'International stock return comovements,' Bekaert and Harvey, 'Time-varying integration,' Bekaert, Harvey and Ng, 'Market integration,' Bekaert, Harvey and Lumsdaine, 'Dating the integration,' Eiling and Gerard, 'Emerging Equity,' Lehkonen, 'Stock market integration'.
[26] Goetzmann, Li and Rouwenhorst, 'Long-term,' p. 21
[27] Edelstein, 'Overseas investment', p.150-157

industries. Le Bris[28] has examined whether US and French securities experienced similar risk and return trade-offs.

Pukthuanthong and Roll, 'Global market integration,' have argued that if there are actually multiple risk factors, the explanatory power (R^2) from a regression including these factors should provide a better measure of integration than simple correlations. They argue that this measure makes sense intuitively as 'if there is no unexplained variation at all (i.e., if the multi-factor R-square is truly 1.0), global influences account for everything. It is hard to imagine that this means anything other than perfect integration. Conversely, if local or regional influences explain all of a country's returns, the country is completely segmented financially for all practical purposes.[29],

We embrace this focus on R^2 and apply it within the context of the London and New York Stock Exchanges, by regressing the returns of a market index of securities listed on NYSE against various LSE risk factors. Intuitively, we are asking how well the returns of the New York market can be explained by the returns of different segments of the London market. If the R^2 is high it means New York and London are moving closely together, and are strongly integrated. If the R^2 is low it means New York is moving differently from London, and they are not integrated.

We analyse several possible mechanisms by which the New York and London Stock exchanges could have been integrated. Firstly, we analyse the co-movement between US and UK stocks on NYSE and LSE respectively, to analyze whether domestic assets tended to be affected in the same way by some common factor. The second approach considers whether controlling for different characteristics in stocks, such as their size, yield or industry, had an impact. The third focuses on the role played by international listings on LSE, to determine

[28] Le Bris 'Shocks Impact'. Hekimian and Le Bris 'US Crashes' also look for contagion between US and French stocks after the 1929 Wall Street Crash using adjusted correlation coefficients.
[29] Pukthuanthong and Roll, 'Global market integration,' p.219

whether companies with greater exposure to the US economy moved in line with those listed on NYSE. The fourth examines those cross-listed stocks which were traded on both LSE and NYSE, to evaluate how closely the two exchanges were integrated when pricing the same assets.

Our results suggest that there was little integration between domestic stocks from the UK and USA. An examination of the historical context also suggests that the prices of domestic stocks on both exchanges showed little evidence of co-movement. Any correlation which did occur may have been the result of domestic factors in each respective country, which happened to move both markets in the same direction. Controlling for the different characteristics of stocks makes little difference. For example, although companies listed on NYSE tended to be much larger, there is little evidence that a size factor helps to explain more of the returns.

However, there was a higher level of integration between NYSE and those companies listed in London that operated primarily overseas. From the start of the sample period, in 1825, companies whose main business operations were outside the UK were listed on LSE, and these stocks became increasingly more common as time progressed. By the 1870s the number of US securities listed on LSE became substantial, and were highly correlated with those traded on NYSE. A sub-group of these companies were cross-listed on both exchanges, and these stocks had very strong integration. This implies that investors trading via just the LSE could get exposure to almost exactly the same type of companies as those listed on NYSE.

These results provide useful insights into the mechanisms by which asset markets integrate, an area which has received considerable attention recently[30]. During this era, there

[30] Pukthuanthong and Roll, 'Global market integration,' Bekaert, Hodrick and Zhang, 'International stock return comovements,' Bekaert and Harvey, 'Time-varying,' Bekaert, Harvey and Ng, 'Market integration,' Bekaert,

was a sustained period which saw close economic ties and stable exchange rates based on the gold standard, very high levels of capital mobility, and strong communication links. However, domestic securities still did not move in similar ways. This would imply that even though there may be strong links between different markets, this does not necessarily lead to greater integration. Much higher levels of co-movement were experienced by those companies which had an international focus. This finding may help to explain why greater integration has been observed in equity markets in recent decades[31]. Firms have become ever more international, and tend to be more exposed to global factors as a result, meaning that they tend to co-move with each other more. The rise in integration may therefore reflect greater fundamental interdependence amongst firms, rather than some form of financial market contagion[32].

From an historical point of view, it also provides an important limit to the view that pre-World War 1 was the first era of globalization in terms of capital market integration.[33] The domestic securities on London and New York did not consistently co-move with each other, which would imply that their prices were still primarily affected by national considerations. The slightly higher correlation amongst securities immediately before World War 1, which has been noted in other studies[34], was transitory. Similar levels of co-movement had been reached in the 1830s and 1880s, and an examination of historical events suggests that these patterns could easily have been produced by domestic factors which happened to move stocks in the UK and USA in the same direction for a short period. It was only the presence on London of international companies, particularly those which operated in

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Harvey and Lumsdaine, 'Dating the integration,' Eiling and Gerard, 'Emerging Equity,' Lehkonen, 'Stock market integration'.

[31] Pukthuanthong and Roll, 'Global market integration'.

[32] Forbes and Rigobon, 'No contagion'

[33] O'Rourke and Williamson, 'Globalisation and history' p.225, Obstfeld and Taylor, 'Global Capital Markets' p.121, Bordo, Eichengreen and Irwin, 'Was there really', Volosovych, 'Market integration', and Mauro, 'Emerging market spreads'.

[34] Goetzmann, Li and Rouwenhorst, 'Long-term,' p. 21, Obstfeld and Taylor, 'Historical Perspective' p.159, Moore, 'World War One'.

the United States, which provided a deep connection between the markets. Our findings suggest that integration was deeper in some respects, but narrower in others, than some may have expected. It did not permeate throughout the exchanges, with domestic equities not moving closely together. However, at the other extreme, integration was not just limited to those identical assets which were traded on both exchanges. Having international stocks listed, even if they were not cross-listed with New York, provided a mechanism for integration.

The paper also broadens our understanding of how both the London and New York Stock Exchanges developed historically[35]. It builds on previous work which has looked at the arbitrage opportunities involving cross-listed stocks[36], and market correlations[37], to consider how a range of risk factors, and sub-sectors within the market, may have played a role in connecting the exchanges. The results highlight the importance of international stocks listed on London, which have recently been examined by Grossman[38]. The analysis is also particularly enlightening with regards to the pricing of stocks on the NYSE[39], as it reveals their exposure, or lack of, to UK and international factors. The findings also contribute to our understanding of the diversification opportunities available to investors in the nineteenth and early twentieth centuries[40]. The lack of sustained correlation between domestic UK and US securities suggests that British investors would have benefitted from holding assets from both countries. In addition, they could easily have done this after 1870 via the London Stock Exchange, with little additional need to use the New York Stock Exchange.

[35] Michie, 'London and New York,' and Davis and Neal, 'Micro rules,' 'How it all began,' have looked at the evolution of the exchanges from an institutional perspective.
[36] Neal, 'International Capital Markets,' 'Disintegration,' Michie, 'London and New York,' Hoag, 'Atlantic telegraph', Sylla, Wilson and Wright, 'Trans-Atlantic capital markets' and Garbade and Silber, 'Technology'.
[37] Goetzmann, Li and Rouwenhorst 'Long-term'
[38] Grossman, 'Bloody Foreigners'.
[39] Goetzmann, Ibbotson and Peng, 'NYSE 1815 to 1925'.
[40] Edelstein, 'Overseas investment', Goetzmann and Ukhov, 'British investment', Chabot and Kurz, 'Where the money was', Edlinger, Merli, and Parent, 'Optimal world portfolio'

2. Data

The data used in this analysis is obtained from a range of sources, as shown in Table 2, running on a monthly basis from 1825 to 1925. Data on British equities listed on the London Stock Exchange between 1825 and 1868 was provided by Acheson et al.[41], who used the *Course of the Exchange* (COE) as their source. This has been supplemented for this paper with all foreign companies listed in the COE during this period, by manually inputting the data from the original source, and from *Global Financial Data* (GFD). All preference shares and corporate bonds during this period have also been obtained from GFD. The original source for the GFD information was *The Times*.

<< INSERT TABLE 2 >>

The *Investors' Monthly Manual* (IMM) has been used to obtain data on companies listed on the London Stock Exchange between 1869 and 1925. It was somewhat more comprehensive than the earlier sources, with a jump in the number of securities included when this source became available. The original data has been inputted by the Yale International Center for Finance, and includes ordinary equities, preference shares, and corporate bonds.

Data on ordinary equities and preference shares on the New York Stock Exchange has been obtained from the dataset compiled by Goetzmann et al.[42], which has also been published by the Yale International Center for Finance. This has been supplemented with data on corporate bonds from Sylla, Wilson and Wright[43] from 1825 to 1853, the *New York Times*, from 1854 to 1856, and Macaulay[44] from 1857 to 1925.

[41] Acheson et al., 'Rule Britannia'.
[42] Goetzmann, Ibbotson and Peng, 'NYSE 1815 to 1925'.
[43] Sylla, Wilson and Wright, 'Trans-Atlantic capital markets'
[44] Macaulay, 'Movements of Interest Rates'

The number of securities, and the breakdown by asset type, are shown in Table 3, for both London and New York. The number of securities is generally much less for the NYSE than for the LSE, which may partly reflect a difference in how many stocks were reported in the original sources, but was also due to a lower number of securities being listed on New York than London. This was as a result of a conscious decision by New York to restrict their listings to just very large firms[45].

<< INSERT TABLE 3 >>

All share prices are converted to British Pounds. For the risk-free rate, the discount rate on prime bills in Britain is used and is obtained from Parliamentary Papers[46] for 1825 to 1855, from Nishimura[47] for 1856 to 1869, and from Capie and Webber[48] from 1870 to 1925.

We have also been kindly provided with market indices for Paris by Le Bris and Hautcoeur[49], and for Brussels by Annaert et al.[50]. These have allowed us to analyse if the integration between London and New York was as deep as the integration between London and other European exchanges.

We calculate market indices using price-weighted returns, with the returns calculated as the change in price plus the dividend, divided by the previous price. The returns on all portfolios included in regressions are equally weighted averages of the log returns of individual assets. We also calculate just the capital gains on each portfolio, and report results using them for robustness. Asset and portfolio returns are winsorised to reduce the impact of outliers. This means that the most extreme negative returns were set to the level of returns at the 2.5th percentile, and the most extreme positive returns were set to the level of returns at

[45] Michie, 'London and New York', p.185
[46] Parliamentary Papers, 'Bank Acts'.
[47] Nishimura, 'London money market'.
[48] Capie and Webber, 'Monetary history'.
[49] Le Bris and Hautcoeur, 'Paris Stock Exchange'
[50] Annaert et al. 'Brussels Stock Exchange', Annaert et al. 'Long-run stock returns', Annaert et al. 'New Belgian'

the 97.5th percentile. More detail on the extensive data compilation and checking process is given in the Appendix.

3. Background

Trading in financial assets in London became regularized with the issue of government debt in the 1690s[51]. Most transactions were conducted in coffee houses during the eighteenth century, before a building was opened for trading in 1773[52], and admission was controlled by the opening of a subscription room for members in 1801[53]. In New York, the market for trading securities became more regular with the issue of debt by the newly independent United States in the 1780s. A group of brokers signed the Buttonwood agreement in 1792, where they agreed to deal with each other first, and set minimum commission rates[54]. The New York Stock and Exchange Board was then formally established in 1817[55].

Market indices which have been constructed for this paper, for both New York and London, are shown in Figure 1 for the period from 1825 to 1925. Panel A shows the total returns, including dividend payments, whilst Panel B focuses on just the capital gains from share price movements. Each of the indices is price weighted, and the returns and capital gains are calculated after converting the prices of all securities to British pounds.

<< INSERT FIGURE 1 >>

The total return indices, in Panel A of Figure 1, both rise substantially over time, highlighting the major role of dividends in rewarding investors, but due to the scale it can be difficult to detect short-term fluctuations. The capital gains indices, in Panel B of Figure 1,

[51] Michie, 'London stock exchange', p.18, Morgan and Thomas, 'The stock exchange,' p.21
[52] Michie, 'London stock exchange', p.32, Morgan and Thomas, 'The stock exchange,' pp.67-68
[53] Michie, 'London stock exchange', p.34
[54] Sobel, 'Big board', pp.20-21
[55] Sobel, 'Big board', p.30, Geisst, 'Wall street', p.20

illustrate these more clearly, and suggest that there were substantial differences in the movement of asset prices on London and New York. There tended to be less volatility on London, and it drifted downwards throughout the period. In comparison, New York often experienced substantial movements, and trended upwards over time.

In terms of connections between the markets, certain episodes may be highlighted. There was a decline in both markets in the late 1820s, with Britain suffering after the 1825-26 crisis[56]. New York experienced its own difficulties, with an economic slowdown, and the failure of the Franklin Bank in 1825[57]. In the 1830s the decision by President Jackson to not renew the charter of the Second Bank of the United States led to a banking crisis and depression[58]. This may have contributed to the difficulties faced by the Bank of England between 1836 and 1839[59], although other domestic factors also contributed. In Britain, the Railway Mania took hold in the 1840s[60], with many European and Colonial railways coming to market, but American railroads were notable by their absence.

In the 1850s, railroad shares in the United States declined and led to problems in the financial sector in 1857[61]. This has been referred to as the first global crisis, with difficulties on both sides of the Atlantic, although Britain had been experiencing its own problems anyway[62]. The American Civil War in the early 1860s led to major volatility in New York, but Britain remained neutral and asset prices in London were fairly stable.

With the laying of the transatlantic telegraph cable in 1866, there was almost instantaneous communication between the two cities. The 1870s saw the beginning of an

[56] Neal, 'Financial crisis of 1825', Haupert, 'Panic of 1825'
[57] Geisst, 'Wall street', p.30
[58] Walton and Rockoff, 'American Economy', pp.258-266, Rousseau, 'Jacksonian', Timberlake, 'Panic of 1837', pp. 514-516, Temin, 'Jacksonian', pp. 113-171, Wallis, 'Crisis of 1839'
[59] Temin, 'Jacksonian', pp. 137-147, Gayer, Schwartz and Rostow, 'Growth and fluctuation', p.243-244
[60] Campbell, 'Myopic rationality'
[61] Kelly and O Grada, 'Market Contagion', O Grada and White, 'Panics', Calomiris and Schweikart, 'Panic of 1857', Sobel, 'Big board', p.61
[62] Rockoff, 'Crisis of 1857', Hughes, 'Commercial crisis of 1857'

expansion in the number of foreign stocks listed on London[63], many of which were from the United States. There were also periodic crises in both markets, but little evidence of substantial transmission between London and New York. In Britain, problems arose after the failure of Overend and Gurney in 1866[64], and the City of Glasgow Bank in 1878[65]. In the United States, Jay Cooke failed in 1873[66], and Grant and Ward in 1884[67].

In 1890, London was affected by a deterioration in the Argentine economy which led to difficulties for Barings[68], who had underwritten some of these issues. In New York, some brokerages experienced difficulties during the summer of 1890[69], but NYSE was still almost entirely without South American issues[70]. However, the United States experienced its own problems in 1893, following the Sherman Silver Purchase Act[71], which soon led to a serious reduction in the reserves of gold within the United States. There was a sustained bull run in New York between the start of 1895 and the end of 1906, but London remained fairly stable. In 1907, another crisis hit New York with the failure of the Knickerbocker Trust[72], and prices also declined somewhat in London.

With the outbreak of war in July 1914, the stock exchanges in Continental Europe began to close. This was followed by London, and then New York[73]. When New York reopened several months later it went on to boom, until the United States entered the war in April 1917, and then declined. On the contrary, prices in London declined until early 1917,

[63] Grossman, 'Bloody Foreigners'
[64] Bignon, Flandreau and Ugolini, 'Bagehot for beginners'
[65] Acheson and Turner, 'City of Glasgow'
[66] Mixon, 'Crisis of 1873', Glasner, 'Crisis of 1873'
[67] Geisst, 'Wall Street', p. 103-104, Sobel, 'Big board', p.118
[68] Morgan and Thomas, 'The stock exchange', p.95, Mitchener and Weidenmier, 'Baring crisis', Eichengreen, 'Mexican mirror', Triner and Wandschneider, 'Brazilian'
[69] Sobel, 'Big board', p.133
[70] Michie, 'London and New York', p.241
[71] Carlson, 'Panic of 1893', Ramirez, 'Bank Fragility', Dupont, 'Bank Runs'
[72] Bruner and Carr,'The panic of 1907', Moen and Tallman, 'Role of Trust Companies', Odell and Weidenmier 'Real Shock', Walton and Rockoff, 'American Economy', pp.446-447
[73] Roberts, 'Saving the City', Silber, 'When Washington', Silber, 'World War 1', Rockoff, 'Until it's over', Morgan and Thomas, 'The stock exchange', p.217

but then started to rise. As the war ended, price rises were evident on both exchanges. The years of 1920 and 1921 saw declines on both markets, but both grew strongly between the start of 1922 and the end of 1925.

4. Domestic Stocks

To analyse the integration between London and New York we focus on several different mechanisms by which it could have occurred. The first measure of integration to be examined is the connection between US firms traded in New York, and UK firms traded in London. This will provide insights into whether the domestic securities in both countries moved in similar ways. Equally-weighted market returns were calculated for NYSE and LSE respectively, for each month of the sample period. The returns on the New York market index were then regressed against the returns on the London market index. One lag and lead of the independent variable are also included to control for the time lags in information moving across the Atlantic at the start of the sample period. Cross-listed securities, those which were listed on both exchanges, are excluded from the analysis in this section and the next few sections, but are examined separately later.

The regressions were performed using a rolling window of 120 observations, equivalent to 10 years of monthly data[74]. The R^2 from each of these rolling regressions is reported in Figure 2, centred around the midpoint of each regression's sample period. For example, the R^2 from the 1826-1835 regression is reported in 1830, and the R^2 from the 1916-1925 regression is reported in 1920.

<< INSERT FIGURE 2 >>

[74] For robustness we have also repeated the analysis using a window size of 60 observations, but there is little difference in the results.

The results suggest that the co-movement between securities on London and New York varied substantially over time, but there was not a secular increase in integration over the sample period. The R^2 for 1827-37 is very similar to the cyclical peaks in co-movement which occurred between 1879-89 and 1904-14. There are also several periods when there is close to zero co-movement, 1863-74, 1895-1905, and 1908-19.

Table 4 presents descriptive statistics on the periods where integration was highest and lowest, showing economic growth, government bond yields, and exchange rate volatility within each period. There does not appear to be a clear pattern as to what may cause integration. Average returns on securities are sometimes similar on average during peak integration, but they can also be similar on average during troughs in integration, even though they may have moved in different ways around this average. Correlations in GDP growth between the US and UK are fairly similar regardless of whether there was relatively high or low asset market integration. A similar result appears for interest rates.

<< INSERT TABLE 4 >>

It has been suggested that capital mobility may play an important role in capital market integration[75]. However, there were extremely few restrictions on capital movement for almost the entire period. The major exception was World War I when the British government imposed controls. There was a dip in integration during this period, but this could also be explained by differing exposures of securities in both countries to the war. Prior to US entry into the war in 1917, security prices on London declined whilst those in New York increased. After US entry, London prices increased, whilst New York prices declined. Another short period of restricted capital movement occurred in 1906, when the Bank of England stopped discounting US bills[76]. This was an attempt to reduce the outflow of gold

[75] Quinn, 'Capital account liberalisation', Quinn and Voth, 'A century'
[76] Odell and Weidenmier, 'Real shock'

which came when British insurance companies compensated those who had suffered loss in the San Francisco earthquake. There is little evidence to suggest that this restriction on capital mobility led to reduced integration as it fell within the period of 1904 to 1914, one of the periods when R^2 was at its highest.

A similar problem occurs from a suggestion that integration was aided by exchange rate stability. In support of this hypothesis, the two periods involving the US Civil War and World War I were marked by higher exchange rate volatility. However, the third period of low integration occurred in the midst of the gold standard era.

The improved communications between London and New York, as a result of the laying of the transatlantic telegraph in 1866, may have improved the consistency of pricing of cross listed assets[77] which will be considered in a later section. With two peaks in integration after this opening it could also be regarded as promoting integration between different assets. However, the low integration in 1895-1905 and 1908-1919, opposes this conclusion.

Two of the periods of least integration, the US Civil War era and World War I, included major conflicts which affected each country differently. During the US Civil War the UK remained neutral. During World War I, the US remained neutral until 1917. However, the third period of low integration occurred from 1895 to 1905. Britain fought the Boer War during this period, but this is unlikely to have been sizable enough to explain the divergence between London and New York. It was a sustained bull run in New York, which did not occur in London, which led to such low integration at this time. Consequently, differing exposure to war may help to explain why companies in each country moved in different ways, but this was not the only reason for low integration.

More generally, it may have been that the periods of higher integration merely occurred because of temporary correlations in the economic conditions in the UK and US.

[77] Hoag, 'Atlantic telegraph'

The level of integration did not remain stable for sustained periods. It rose and fell quite dramatically throughout the sample, as shown in Figure 2, suggesting that there was not an equilibrium level of integration that it remained around. Also, the narrative of events discussed in the previous section, suggests that even when prices did move in the same direction, there was little suggestion of common exposure to the same events.

5. Characteristics

Rather than using the market as a whole, Fama and French[78] have suggested using five risk factors for explaining the returns on bonds and stocks. The first factor, Term, is the difference in returns due to the term structure of interest rates. It is calculated as the difference between the risk-free rate and the return on long-term high quality government bonds. In our paper this is the difference between the returns from short-term first class bills, and long-term British government Consols.

The second factor, Def, is the difference in returns due to default risk, and is calculated as the difference between safe government bonds and risky corporate bonds. We calculate this as the difference between the returns on British government Consols and a portfolio of all corporate debt listed on the London Stock Exchange.

The other three factors focus on equities. The market return of all equities is calculated, and the risk-free is subtracted from it. Fama and French[79] have found that size and the relative value of a company are also determinants of returns. Other research has examined if these factors were significant historically. Turner and Ye[80] have found that for

[78] Fama and French, 'Common risk factors', 'Multifactor'
[79] Fama and French, 'Common risk factors', 'Multifactor'
[80] Ye and Turner, 'Cross-section'

1825 to 1870 there was a value premium, but little evidence of a size premium. Similarly, Grossman[81] has found that for 1869 to 1929, value was significant, but size was not.

Size could have been important as firms listed on New York tended to be larger than those listed on London. Michie has calculated that by 1914 the average size of firms listed on New York was five times that of London[82]. To construct the size factor, all of the UK equities on the London Stock Exchange were categorized as either Small or Big based on whether their market capitalization was above or below the median at the end of the previous year. Equally weighted portfolios of returns were then calculated for each month based on this categorization. The factor SMB was constructed as the returns on the Small portfolio Minus the Big portfolio.

A factor was also constructed based on whether an asset could be classified as a value stock. Fama and French[83] use the book equity to market equity ratio as the basis for calculating this. However, this variable is not available during this period so we follow Turner and Ye[84], and Grossman[85], in using the dividend yield as a proxy. The yield on investments was an important feature during this era, with the yield on Consols providing a benchmark for low risk investments. Each UK equity listed on London was categorized as being either High or Low yield, depending on whether it was above or below the median yield at the end of the previous year. Companies which did not pay dividends are necessarily excluded as they always had a dividend of zero, which does not reveal anything about their pricing[86]. The monthly returns on the High and Low yield portfolios were calculated as

[81] Grossman, 'Cross-section'
[82] Michie, 'London and New York'
[83] Fama and French, 'Common risk factors', 'Multifactor'
[84] Ye and Turner, 'Cross-section'
[85] Grossman, 'Cross-section'
[86] As a robustness check we have repeated the analysis including zero-dividend payers in the same portfolio as those with a High dividend yield. There is almost no difference with the main results so we do not report the results separately.

equally weighted averages of their constituent companies, and the HML factor was constructed as High Minus Low.

We also construct another factor based on the railway industry, as both New York and London hosted numerous railways, as shown in Table 3. If railway, or non-railway, share prices tended to move similarly, regardless of where they were located, prices may have been partially explained by this industry factor. The Rail factor is calculated as the equally weighted returns of UK railway companies listed in London, minus the equally weighted return of all other UK companies listed on London.

We also calculate a factor based on whether companies were likely to export goods. Returns on UK firms which operated in commercial and industrial sectors where products could have been traded internationally[87], were compared to those where exporting would have been less likely[88], to create the Export factor. It is possible that New York may have moved more like the UK firms which were more likely to export goods, as these firms may have been more exposed to international factors. Cross-listed securities are excluded from all of these factors.

The results of regressions for the entire sample period are shown in Table 5. The results suggest that there is little additional explanatory power from these other risk factors. The market factor, which is highly significant, provides an adjusted R^2 of 0.072 across the whole period. Although the Rail factor is significant, indicating that New York moved more like non-railways on London, there is little increase in explanatory power. The Export factor is also significant, indicating that New York moved more like those UK firms in industries which were more affected by international trade, and the adjusted R^2 increases slightly.

[87] The industries treated as potentially exporting products were Insurance, Iron, Coal, Steel, Mines, Nitrate, Oil, Other, Rubber, Shipping, Spinning, Tea, Telegraph, Trusts, and Wagons

[88] The industries treated as unlikely to be exporting products were Banks, Breweries, Canals, Docks, Electric, Gas and Water, Land, Railways, Tramways and Waterworks

However, even with the inclusion of all of the additional factors the adjusted R^2 is little changed at 0.097.

<< INSERT TABLE 5 >>

Figure 3 charts the adjusted R^2 of the rolling regressions when the characteristic factors are incorporated. The inclusion of these factors increases the adjusted R^2 slightly, particularly in the first quarter of the sample. Integration was not sustained for any considerable period, and the peaks and troughs are almost identical as when only the market factor is included. This suggests that New York did not co-move with particular sub-sections of UK securities listed on London.

<< INSERT FIGURE 3 >>

To place these results in context, it may be useful to compare them with an analysis of how integrated London was with other European exchanges. Le Bris and Hautecour[89] have kindly provided us with their market index for the Paris Stock Exchange, beginning in 1854. Annaert et al.[90] have also been very helpful in providing their index for the Brussels Stock Exchange, beginning in 1832. We analyse how exposed these markets were to our London risk factors in Table 6. We also re-run our analysis for New York for the same time periods, and focus on just ordinary equities, to be consistent with the other European indices.

<< INSERT TABLE 6 >>

We find very similar results in terms of the explanatory power, with R^2 around 10% for each of the exchanges. We also repeat our rolling regressions in Figure 4. The patterns are somewhat similar, although they diverge at times which may be expected. For example, New York has a lower R^2 with London, than the other European exchanges do, during the U.S. Civil War, and World War I. Nevertheless, the main conclusion is that, controlling for the

[89] Le Bris and Hautcoeur, 'Paris Stock Exchange'
[90] Annaert et al. 'Brussels Stock Exchange', Annaert et al. 'Long-run stock returns', Annaert et al. 'New Belgian'

characteristics of securities, London was integrated with New York, Paris and Brussels to similar degrees. There was not really a sustained or high level of integration with any of the exchanges.

<< INSERT FIGURE 4 >>

To examine whether there were differences between security types, Table 7 analyses NYSE equities (ordinary shares) and non-equities (preference shares and bonds) separately. The returns on NYSE equities are explained using the returns on LSE equities in the first column giving an R^2 of 0.072, and when the other risk factors are included in the third column this rises to 0.098. These results are very similar to the results in Table 5 when all NYSE securities are analysed together. The returns on NYSE non-equities, shown in column 2, is significantly related to changes in the term structure of interest rates, and the default risk of corporate bonds in London, but the R^2 is very low at 0.015. When other risk factors are included, in the fourth column, it can be seen that the return on NYSE non-equities is also significantly related to the return on LSE equities and railways, and the R^2 rises to 0.057. Given the common patterns explaining both NYSE equities and non-equities it seems justified to include all of the NYSE securities in a single portfolio for the rest of the analysis.

<< INSERT TABLE 7 >>

6. Foreign Listings

Although New York almost exclusively listed companies based in the USA[91], London had a large number of foreign firms listed. This was evident from the beginning of the sample period in 1825, but became more pronounced after 1870[92]. Bekaert et al.[93] have noted that

[91] Moore 'World Financial Markets', p. 36, notes only 3 foreign assets were listed on the New York Stock Exchange in 1900.

[92] Grossman, 'Bloody Foreigners', analyses the growth in listings and their returns. Edelstein, 'Realized rates', 'Overseas investment' assesses whether overseas investment was optimal for British investors. Chambers, 'Geography and capital', finds that the listing of US railroads in London became much more common after

regional factors may play a role in asset pricing, but suggests that this implies a weaker degree of interdependence than exposure to global factors. By analyzing the co-movement of New York with the foreign companies listed on London we can examine how much influence region-specific considerations had.

We construct three factors, each consisting of firms listed on the London Stock Exchange. The first, NonUK, consists of all firms with operations mainly outside the UK. The second, Americas, consists of all firms operating in either North or South America. The third, USA, includes those firms focused in the United States. To avoid problems of multicollinearity, we orthogonalise each of the international market factors by regressing it against the UK market factor.

Cross-listed companies, which were traded on both exchanges, could give the appearance of higher integration, simply because some of the assets which were being traded were identical. To deal with this, we exclude them from this analysis, and deal with them separately in the next section. Consequently, all of the factors discussed here exclude cross-listed stocks, so for example, the USA factor consists of those firms operating in the United States which were listed on London but not on New York. It completely excludes companies which have any securities trading on both exchanges. For example, if a stock for Company ABC was listed in New York, but a bond for Company ABC was listed in London, then Company ABC is completely removed from this analysis. Only 27% of the companies in this USA factor are railways. This is largely because it was the railways which were most likely to cross-list, and are consequently removed from this section. The majority of companies in this factor are therefore non-railways, and include companies from industries such as Breweries, Land and Mortgages, Mines, Oil and Telegraph.

1870, and may have been driven by regional considerations. Hawkins, 'American boomers' provides insights into the promotion of overseas firms.

[93] Bekaert, Hodrick and Zhang, 'International stock return comovements,'

There are less than 10 US firms in our dataset listed in London before 1870, so the analysis is run just from 1870 onwards for the USA factor. After this period the US firms grew to represent a major proportion of market capitalization, reaching about 40 per cent of the value of all the securities listed in London in 1915, as shown in Figure 5.

<< INSERT FIGURE 5 >>

The regressions in Table 8 show the exposure of New York to each of the international factors. The results are shown for the full sample period, 1825-1925, and for the period when the number of international listings became more substantial, 1870-1925.

The results imply that New York did not show particularly strong integration with either NonUK or Americas firms. For the full sample period, the adjusted R^2 remains almost unchanged, being 0.097 for the factors based on UK securities, and also 0.097 with a factor for all foreign stocks, rising to 0.107 for just those securities based in the Americas. For the period after 1870, the adjusted R^2 increases from 0.132, to 0.154 and 0.214 respectively.

<< INSERT TABLE 8 >>

However, USA shows up as being a highly significant factor, and increases the explanatory power considerably, to 0.343, for the post-1870 period. This suggests that much of the movement in New York was driven by country-specific considerations in the United States, rather than more general regional factors. To press this further we construct SMB and HML factors based only on US firms listed on London. We split US firms listed on London into Small and Big, High and Low Yield, as was done for the UK factors. We orthogonalise each US factor by regressing it against the relevant UK factor and using the residual from this as the US-specific factor[94]. The adjusted R^2 from the post-1870 period increases further to 0.420 with the inclusion of these factors.

[94] This is consistent with the approach of Bekaert, Hodrick and Zhang, 'International stock return comovements,'

Moving window regressions are then run, using both the UK and US factors to explain the returns on NYSE. The results are shown in Figure 6. The R^2 from these regressions are much higher than for the UK factors alone, consistently explaining at least 40 per cent of NYSE returns, reaching 70 per cent at the peak. These results suggest that rather than showing integration with the broad population of London listed firms, or even foreign firms, the co-movement is restricted to just the segment of the London market consisting of US firms, representing a weaker form of integration.

<< INSERT FIGURE 6 >>

As a robustness check we have also repeated all of our analysis excluding dividends, and only look at capital gains, in Table 9. We find very similar results. Dividends are being added to both dependent and independent variables which will increase the mean of these variables. However, as dividends tend to be fairly stable it has little impact on the deviations of the observations from the mean, and consequently there is little change in the explanatory power of the regressions.

<< INSERT TABLE 9 >>

7. Cross-Listed Stocks

In this section, we examine those stocks which were listed on both markets simultaneously. The datasets for both exchanges were manually compared, and we included any asset which traded on both markets for at least 60 months. The identity of the 36 securities that were found, and the years in which they were listed in our sample for both the London and New York Stock Exchanges, is shown in Table 10. The earliest sustained cross-listing in our sample period is the Second Bank of the United States, which has already been analysed by

Sylla, Wilson and Wright[95], which we include from the start of our sample period in 1825. The number of cross-listings became much more common from the 1880s and 1890s. There were 17 assets in our sample which were cross-listed at the end of our analysis period in 1925.

<< INSERT TABLE 10 >>

Examples of the prices of cross-listed stocks are shown in Figure 7, focusing on the Rock Island Railroad in Panel A, and the New York Central and Hudson River (7% Bonds) in Panel B. The thick double line illustrates the price in New York, whilst the single dotted line shows the price in London, both converted to British Pounds. For both assets, there does not appear to be major deviations between the exchanges.

<< INSERT FIGURE 7 >>

For each of the cross-listed securities, only months in which they were traded on both exchanges are included. This ensures that deviations do not appear because of a lack of trading in one of the markets. We also exclude prices under 2 British pounds, as small deviations in nominal prices can appear large when expressed in percentage terms. For example, prices of 1.00 on one market, and 1.10 on the other could easily be the result of bid-ask spreads, but would appear to be a 10 per cent deviation in prices.

For each of the months the ratio of the log of the price in New York to the log of the price in London was calculated, and is reported in Table 10. The mean of this ratio for each asset is very close to 1.00, indicating very similar pricing on both exchanges on average. The standard deviations of price ratio for some stocks indicate that the prices could often deviate temporarily between the exchanges, although some of this may have been due to bid-ask

[95] Sylla, Wilson and Wright, 'Trans-Atlantic capital markets'. To promote consistency with their approach, we also include prices from the Philadelphia Stock Exchange for the later years of the analysis which they provide in 'Early US Securities Prices'

spreads, trades occurring at different times within the month, or variations in the dollar-pound exchange rate during the month.

Tests of cointegration were also conducted, with the log of the price level in New York regressed against the log of the price level in London[96]. The residual from this regression was then tested for a unit root, using an Augmented Dickey Fuller test. For each asset the residual is highly significant, indicating that there was no unit root, and confirming that the prices in New York and London cointegrated.

A regression is then conducted for each asset, explaining the return in New York using the current, past and future monthly return in London. The lag of the residual from the cointegrating relationship is also included in this regression to form an Error Correction Model, so that if prices deviated from parity during the previous month they could be corrected, and this could help to explain the return during the current month.

The R^2 from this regression for each asset is shown in Table 9, which also shows the results when the analysis is repeated excluding dividends. The R^2 for each asset is very high, with almost all exceeding 60%. The lowest is the New York Central and Hudson River (7% Bonds), which has been illustrated in Panel B of Figure 7. Even for this asset there does not seem to be major deviations from parity. Across time, there does not seem to be much change in the consistency of pricing, with the earliest cross-listing, the Second Bank of the United States having similar results to the later cross-listings, although it should be noted that we have controlled for lags to account for the longer time it took to deliver information across the Atlantic in the early years.

These results suggest a strong similarity in pricing for assets which were traded simultaneously on the London and New York Stock Exchanges. Prices could deviate from

[96] Similar to Sylla, Wilson and Wright, 'Trans-Atlantic capital markets'

parity temporarily, but this can also be the case in the modern era[97]. Using this narrow view of integration, which examines only the exact same asset on two markets, it therefore appears that there was strong integration between LSE and NYSE.

8. Conclusion

This paper has examined the integration between securities listed on the New York Stock Exchange, and those listed on the London Stock Exchange, between 1825 and 1925. The pattern of co-movement between domestic securities listed on each exchange suggests that they did not consistently move in the same direction. Controlling for the different characteristics of stocks on both exchanges does not make much difference to this result. There was a much stronger pattern of co-movement between NYSE and the international stocks which were listed on LSE, particularly with those firms operating in the United States, and those cross listed on both exchanges.

This has implications for our understanding of how deeply integrated the world economy was before World War I. Companies based in the UK and US did not experience similar changes in their asset prices at similar times. If asset prices reflect discounted cash flows, this result implies that the expected performance of companies in each country were not affected by common factors.

It also has broader implications for our understanding of the process of globalisation, and what factors may be responsible for integration. The existence of the gold standard, and almost instantaneous communication, did not lead to highly integrated markets. The most important mechanism for connecting the exchanges was the presence of companies which had a strong international focus.

[97] Lamont and Thaler, 'Anomalies', DeJong, Rosenthal and Van Dijk, 'Dual-listed', Froot and Dabora, 'Location of Trade', and Gagnon and Karolyi, 'Multi-market trading'

The chronology of integration may be conceptualized as a move from isolation, to integrated pricing of the same securities, and then eventually to integration via the rise of multiproduct firms trading internationally. In the early period there were few links between the exchanges. The domestic securities on each market did not move closely together, and there were few international listings. Consistent with Sylla, Wilson and Wright[98] we find consistency of pricing for those assets which were cross-listed at this time, but they were few in number. As time progressed the number of international listings and cross-listed firms increased. This would eventually be followed, in the modern era, by the rise of multinational firms which trade internationally, and which may be the major factor driving capital market integration in recent years.

[98] Sylla, Wilson and Wright, 'Trans-Atlantic capital markets'

Appendix: Data Compilation

London Stock Exchange

Data on share prices, dividends, par values, uncalled capital and the number of shares are reported in the *Course of the Exchange*, and these have been obtained for domestic equities from Acheson et al.[99], and manually inputted for foreign equities from the *Course of the Exchange*, for 1825 to 1868. The financial data provider, *Global Financial Data*, also have asset pricing data for some other equities, preference shares, and corporate bonds which have been obtained from *The Times* and the early editions of the *Investor's Monthly Manual* (IMM) from 1864 to 1868. They do not include dividend or share characteristic data so these are obtained where available from the paper versions of the IMM in these years.

From 1869 the monthly editions of the IMM have been inputted by Yale International Center for Finance. It reports data on asset prices, dividends, par values, uncalled capital and the number of shares, and includes ordinary equities, preference shares and corporate bonds. This database is of great benefit, but it did require considerable additional data checking. To correct for misprints, any occasion where the share price was more than double, or less than half, both the previous and the subsequent price then the price in the anomalous month is removed. The size of the company is sometimes reported in terms of the number of shares, but at other times is reported in term of total value. These two reporting methods are distinguished, and converted so that all observations are reported in terms of total value.

The dividend yield is directly reported in the IMM after 1878. For companies with a missing dividend yield, details of the last four dividend payments are checked to ensure that there was no dividend payment made, and the yield is set to zero. Where dividend payments

[99] Acheson et al. 'British Stock Market Returns'

were made but no yield is reported, i.e. for all companies before 1878, and for a small number after this date, the dividend per share is used to work out a dividend yield.

The IMM includes companies listed on the many regional exchanges of the UK during this era. As the focus of this research is on the London Stock Exchange, only those firms listed as being traded in London, or where no exchange is specified, are included.

For all of the data, from 1825 to 1925, substantial time was also taken in terms of classification. It was common for one company to issue multiple assets. To account for this, all assets have been manually sorted and grouped into companies. Every asset has also been manually categorized as debt, preference or equity, based on information provided in the company and security descriptions. The industry of each company was also coded, with a variable created specifically to identify railways. The name of every company was also manually examined to determine whether it was likely to operate outside the UK. When the name included a place, such as a city, state, or country, the company was deemed to operate extensively within that country, and each company is then classified by region.

New York Stock Exchange

Data on ordinary equity and preference shares on the New York Stock Exchange have been obtained from Goetzmann et al.[100] This data contains monthly share prices, which are again checked for misprints, by excluding those whose price was more than double, or less than half, both the previous and subsequent prices. Dividends are reported, where available, up to 1870 and the dividend yield is calculated from this. After 1870, individual company level dividends are not available, so the dividend yield of the Cowles Index[101] is used as a proxy of the dividend yield of this index. Goetzmann et al.[102] show that a share price index constructed

[100] Goetzmann, Ibbotson and Peng, 'NYSE 1815 to 1925'.
[101] Cowles, 'Common-stock indices'.
[102] Goetzmann, Ibbotson and Peng, 'NYSE 1815 to 1925'.

using this data is highly correlated with the Cowles Index, so the dividend yield should also be very similar.

Each company could issue multiple securities, so all securities were manually sorted and coded into companies. There are no bonds included in the dataset, and preference shares are identified based on the security name. The remainder are classified as equity. Railroad companies are identified based on the name of the company, and usually bear the suffix "RR". All companies are also checked against the Appendix to the Cowles Commission Report[103], which lists companies by industry.

For corporate bonds we use data provided by Sylla, Wilson and Wright.[104] from 1825 to 1853. This dataset often reports both bid and ask prices so we calculate the mid-point. We manually input data on corporate bonds from the *New York Times* between 1854 and 1856. Macaulay's[105] Appendix on Railroad Bond Yields is used from 1857 to 1925. These are reported as Yields to Maturity, but the coupon rate and maturity date of each bond is also given, allowing us to calculate the implied price of the bond. As Macaulay does not distinguish which exchange the bonds are traded on, we compare the company names with those whose equities were traded on New York, according to Goetzmann et al.[106], and restrict our sample to these bonds. With regards the representativeness of the Macauley data, analysis by Mishkin[107] suggests that it performs well. Bernanke[108] uses a measure based on Moody's Baa Corporate bond rate to calculate interest rate spreads from 1919. Mishkin[109] compares this with a measure created using Macauley data for when the two overlap, between 1919 and

[103] Cowles, 'Common-stock indices'.
[104] Sylla, Wilson and Wright 'Early US Securities Prices'
[105] Macaulay, 'Movements of Interest Rates'
[106] Goetzmann, Ibbotson and Peng, 'NYSE 1815 to 1925'.
[107] Mishkin,'Asymmetric Information' p.76
[108] Bernanke, 'Non-monetary'
[109] Mishkin,'Asymmetric Information' p.76

1935. The correlation between the two measures during this period is very high, at 0.88, which would suggest that the Macauley data should be reliable.

Currency Conversion

Stocks listed on New York are converted at the US Dollar to British Pounds exchange rate. Between 1825 and 1861 this is obtained from Smith and Cole[110]. From 1862 to 1878 the exchange rate is calculated by using the dollar price of gold in New York, obtained from Denzel et al.[111], and the price of gold in London which was fixed. Between 1879 and 1913 both countries maintained the gold standard, and the conversion from dollars to pounds is based on the par rate of exchange. Between 1914 and 1925 the exchange rate is obtained on a monthly basis from the *Financial Times*. Many of the American firms which were listed on the London Stock Exchange had their prices quoted in "dollars". However, this was not actually equivalent to US dollars[112]. Before 1874, there were 4.44 London Stock Exchange "dollars" equivalent to one British Pound, but this changed to 5.00 London "dollars" thereafter[113].

Risk-free Rate

In some of the calculations, the risk-free rate is needed as an input. Modern studies often proxy the risk-free rate as the yield on US Treasury Bonds. During this era, the yield on British government debt was almost always lower than US government debt, so it is the British rate which is used as a proxy. The discount rate on prime bills in Britain is used and is

[110] Smith and Cole, 'Fluctuations'
[111] Denzel, Schneider, and Schwarzer, 'Currencies'
[112] This forced publications such as the Financial Times, when reporting prices on the New York Stock Exchange, to report both the US dollar price in New York and the "English Equivalent".
[113] Sylla, Wilson and Wright, 'Trans-Atlantic Capital Markets', p.622. This is also noted in the Stock Exchange Yearbook for American railroads.

obtained from Parliamentary Papers[114] for 1825 to 1855, from Nishimura[115] for 1856 to 1869, and from Capie and Webber[116] from 1870 to 1925.

Consistency between London and New York

Prices on NYSE prior to 1915 were reported as a percentage of their par value[117]. To ensure consistency between the exchanges, the prices of stocks on the LSE were converted so that they were also expressed as a percentage of par during this period. Data is not available for 3.2 per cent of the months during the sample period. This may be because the exchanges were closed, such as during the latter half of 1914 due to World War I, or because no original sources could be found for that month. To ensure consistency, if data is missing for either London or New York, that month is excluded entirely. For the next month, capital gains and returns are calculated between the latest data, and the last available data. For example, the returns for the month ending January 1915, use the change in price between June 1914 and January 1915.

Given the range of sources used, it was necessary to manually line up all of the securities to ensure a continuous dataset. This was done for each exchange individually, and cross-listed assets between London and New York were also matched.

[114] Parliamentary Papers, 'Bank Acts'.
[115] Nishimura, 'London money market'.
[116] Capie and Webber, 'Monetary history'.
[117] New York Stock Exchange, 'Timeline'

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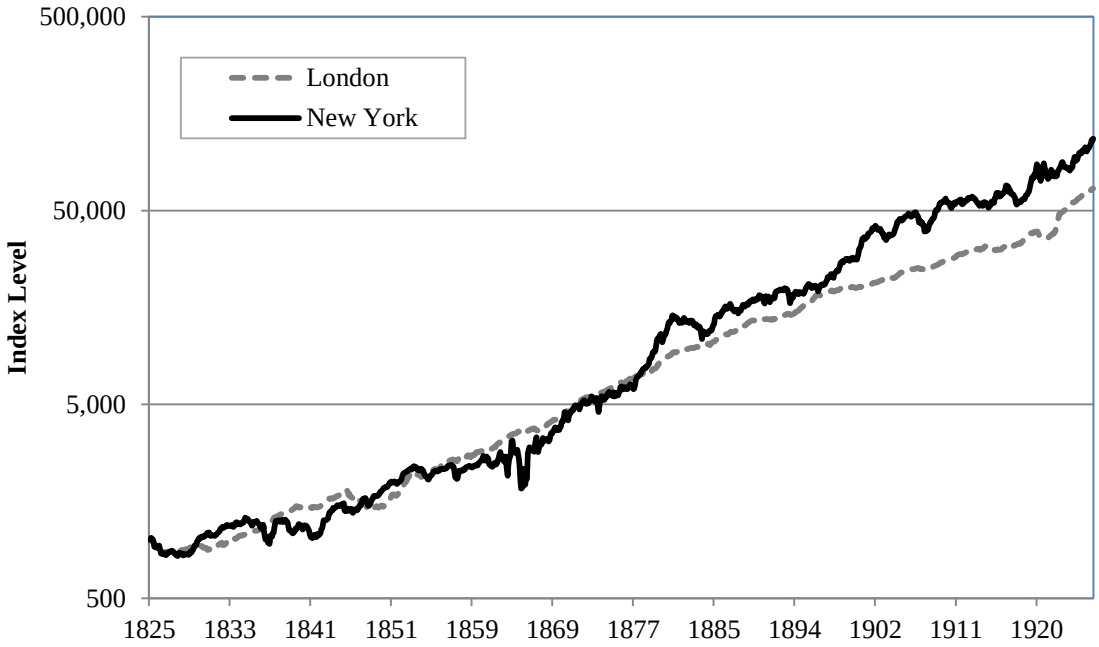
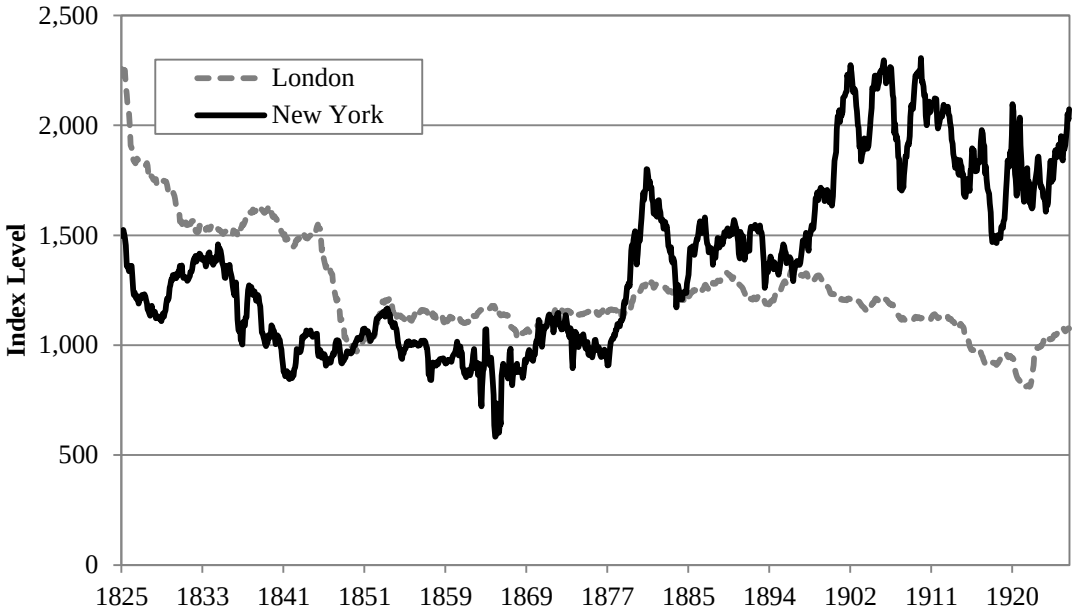
Figure 1: Market Indices of
London and New York Stock Exchanges, 1825-1925

Panel A: Returns

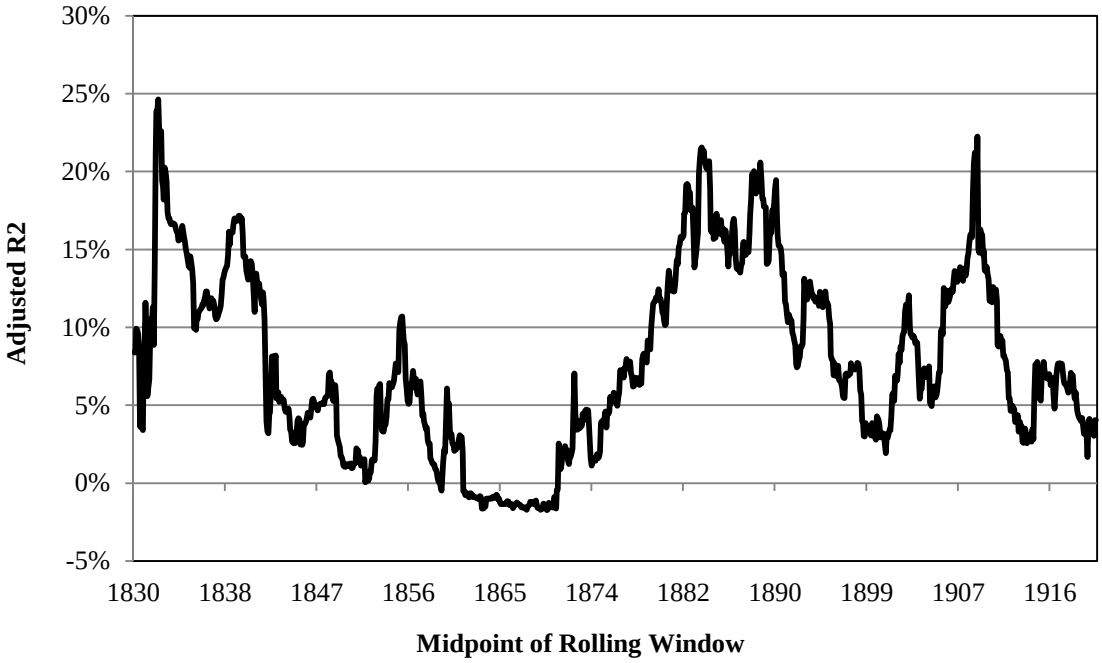


Panel B: Capital Gains



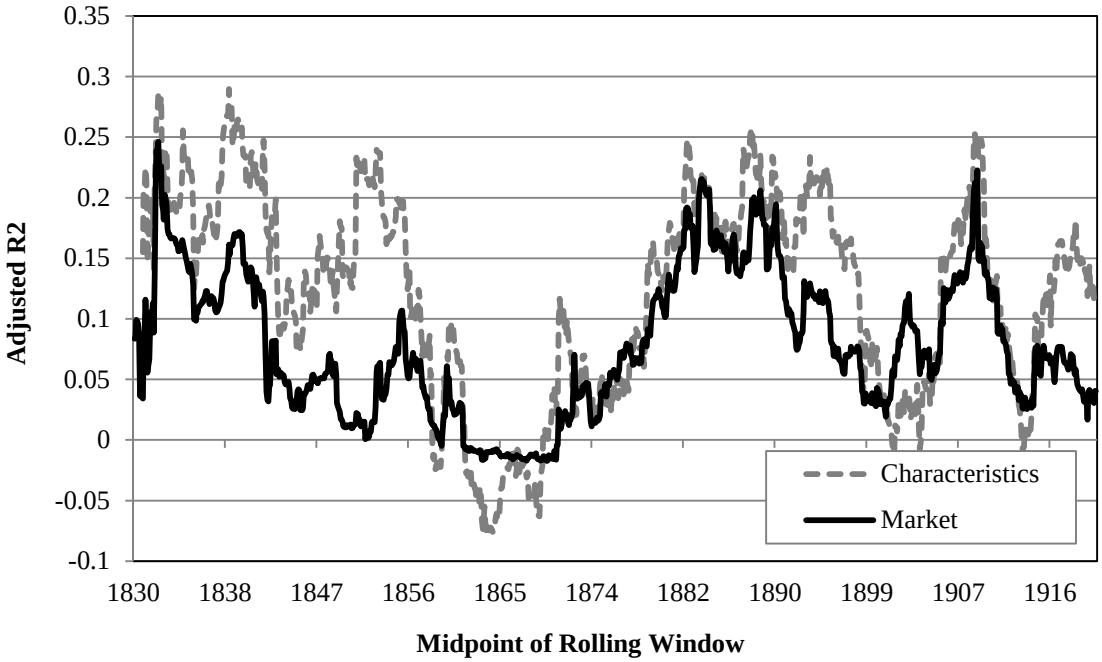
Notes: Price-weighted indices reflect the performance of portfolios which hold one share of each asset listed on the respective stock exchanges. Returns include dividend payments, whilst capital gains reflect only share price changes.

Figure 2: Explanatory Power when NYSE Returns are Regressed against LSE Market Returns, Using Rolling Window Regressions



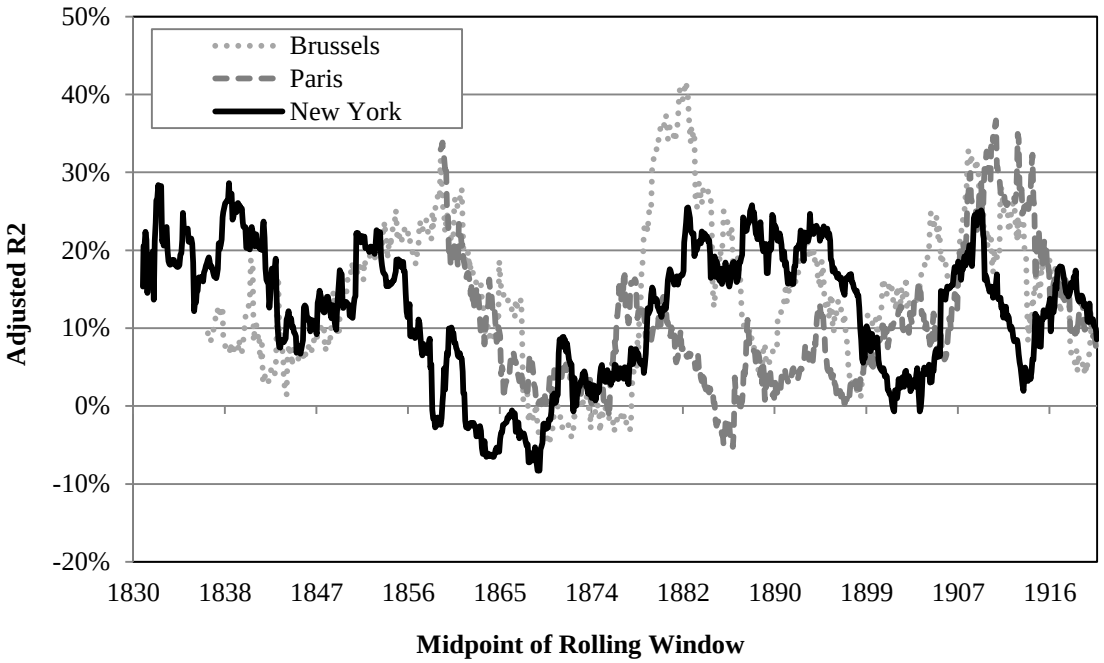
Notes: The returns on a portfolio of US securities on NYSE are regressed against the returns on a portfolio of UK securities listed on LSE, and one lag and lead of this portfolio. Cross-listed securities are excluded. The returns of the portfolios are equally weighted averages of the individual securities. Rolling regressions are performed using 120 month windows. The midpoint of each window is shown, so the adjusted R^2 shown for 1830 reflects a regression analyzing the 120 months between 1825 and 1835.

Figure 3: Explanatory Power when NYSE Returns are Regressed against LSE Market and Characteristic Factors, using Rolling Window Regressions



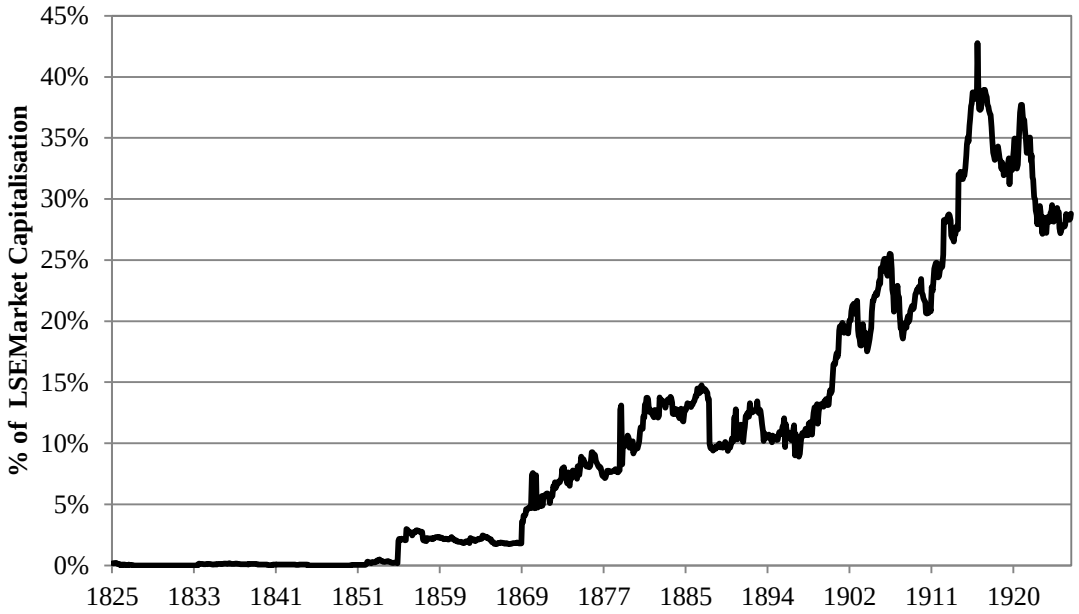
Notes: The Market line shows the results from regressing returns on a portfolio of US equities on NYSE against the returns on a portfolio of UK equities on LSE. The Characteristics line shows the results from regressing the New York return minus the risk-free rate (NYSERf), against risk factors constructed from securities traded on London based on Term structure (Term), Default risk (Def), the Equity market return minus the risk-free rate (LSERf), size (SMB), yield (HML), and whether the company was a railway (Rail) or could potentially export (Export). Cross-listed securities are excluded. The returns of the portfolios are equally weighted averages of the individual securities. Rolling regressions are performed using 120 month windows. The midpoint of each window is shown, so the adjusted R^2 shown for 1830 reflects a regression analyzing the 120 months between 1825 and 1835.

Figure 4: Comparison of NYSE, Brussels and Paris against LSE Market and Characteristic Factors, using Rolling Window Regressions



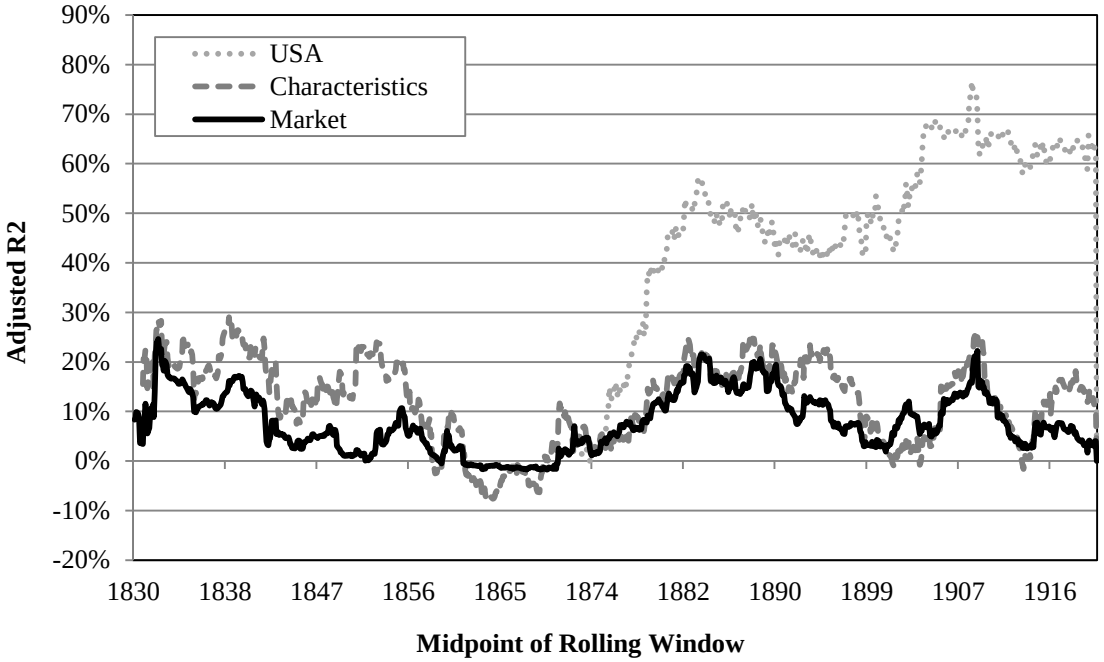
Notes: Returns on equity market indices for New York, Paris and Brussels, minus the risk-free rate, are regressed against risk factors constructed from securities traded on London based on Term structure (Term), Default risk (Def), the Equity market return minus the risk-free rate (LSERf), size (SMB), yield (HML), and whether the company was a railway (Rail) or could potentially export (Export). Cross-listed securities are excluded. The returns of the portfolios are equally weighted averages of the individual securities. Rolling regressions are performed using 120 month windows. The midpoint of each window is shown, so the adjusted R^2 shown for 1830 reflects a regression analyzing the 120 months between 1825 and 1835.

Figure 5: Market Value of US Companies listed on LSE as a Proportion of All Companies listed on LSE



Notes: US securities are identified based on their company names. The market value for each security is calculated as the number of shares multiplied by the asset price. Prices quoted in dollars are converted to British pounds.

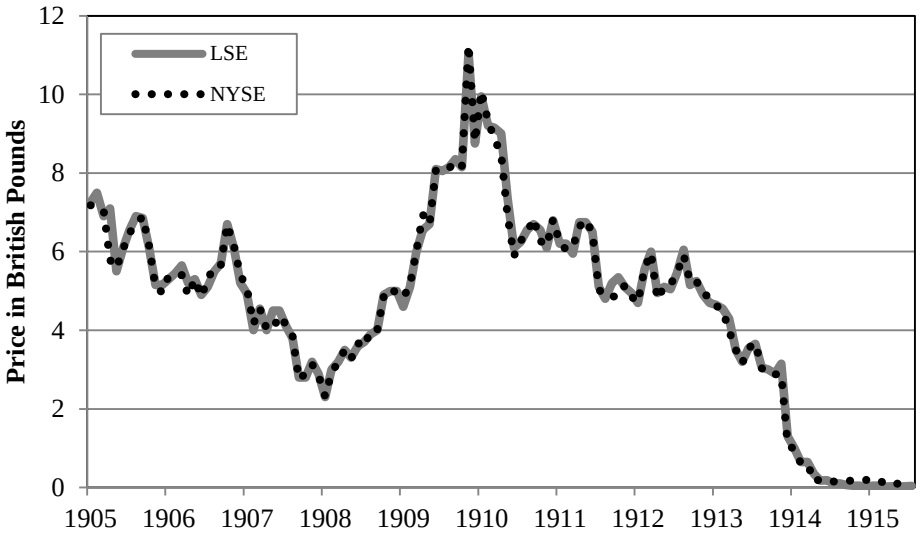
Figure 6: Explanatory Power of NYSE Returns by LSE UK and US Factors, using Rolling Window Regressions



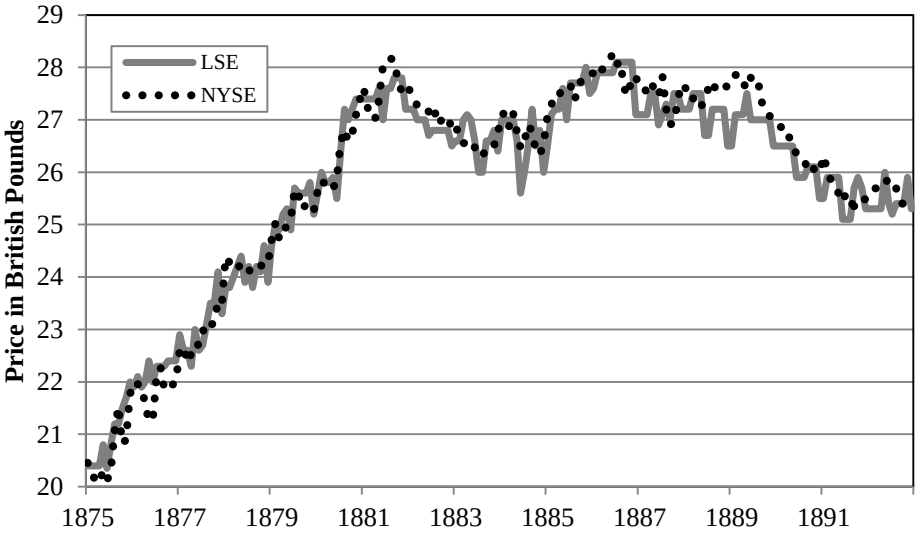
Notes: The Market line shows the results from regressing returns on a portfolio of US equities on NYSE against the returns on a portfolio of UK equities on LSE. The Characteristics line shows the results from regressing the New York return minus the risk-free rate (NYSERf), against risk factors constructed from securities traded on London based on Term structure (Term), Default risk (Def), the Equity market return minus the risk-free rate (LSERf), size (SMB), yield (HML), and whether the company was a railway (Rail) or could potentially export (Export). The USA line shows the results from a regression which also includes a portfolio of US securities listed on LSE, and SMB and HML for US equities. Cross-listed securities are excluded. The returns of the portfolios are equally weighted averages of the individual securities. Rolling regressions are performed using 120 month windows. The midpoint of each window is shown, so the adjusted R^2 shown for 1830 reflects a regression analyzing the 120 months between 1825 and 1835.

Figure 7: Prices of Assets listed on both London and New York Stock Exchanges

Panel A: Rock Island Railroad



Panel B: New York Central and Hudson River (7% Bonds)



Notes: The prices on NYSE and LSE for these cross-listed assets are recorded each month, and converted to British Pounds

Table 1: Comparison of Stock Exchange Sizes

	Total Market Cap (£m)	Number of Equities	Average Market Cap per Equity (£m)
	Panel A: Size in 1925		
London	5,381	2,381	2.26
New York	4,721	548	8.61
Berlin	708	1,050	0.67
Paris	468	243	1.93
Amsterdam	358	581	0.62
Canada	302	234	1.29
Tokyo	188	91	2.07
	Panel B: Size in 1903		
London	2,613	1,379	1.89
New York	1,548	294	5.27
Paris	554	157	3.53
Berlin	474	755	0.63
Johannesburg	216	127	1.70
Vienna	177	186	0.95
Amsterdam	136	286	0.48

Notes: Adapted from Moore 'World Financial Markets', Tables 2 and 4. Includes ordinary equity and preference shares but not corporate debt.

Table 2: Data Sources

	London	New York
Equities	1825-1868: Acheson et al., 'British Stock Market Returns'; Course of the Exchange; Global Financial Data	1825-1925: Goetzmann, Ibbotson and Peng, 'NYSE 1815 to 1925'
	1869-1925: Investor's Monthly Manual (Yale ICF)	
Preference	1825-1868: The Times (Global Financial Data)	1825-1925: Goetzmann, Ibbotson and Peng, 'NYSE 1815 to 1925'
	1869-1925: Investor's Monthly Manual (Yale ICF)	
Bonds	1825-1868: The Times (Global Financial Data)	1825-1853: Sylla, Wilson and Wright, 'Early US Securities Prices'
	1869-1925: Investor's Monthly Manual (Yale ICF)	1853-1856: New York Times
		1857-1925: Macaulay 'Movements of Interest Rates'
	Miscellaneous Data	
Currencies	1825-1861 Smith and Cole, 'Fluctuations'	
	1862-1878 Denzel, Schneider, and Schwarzer, 'Currencies'	
	1879-1913 Gold Standard	
	1914-1925 *Financial Times*	
Risk-free rate	1825-1855: Parliamentary Papers, 'Bank Acts'.	
	1856-1869: Nishimura, 'London money market'.	
	1870-1925: Capie and Webber, 'Monetary history'.	
International	Paris: Le Bris and Hautcoeur, 'Paris Stock Exchange'	
	Brussels: Annaert et al. 'Brussels Stock Exchange'	

Table 3: Composition of Sample

Year	London					New York				
	Number of Securities	% of securities which were:				Number of Securities	% of securities which were:			
		Railways	Ordinary Equity	Preference Shares	Debt		Railways	Ordinary Equity	Preference Shares	Debt
1825	168	1.2%	96.4%	0.0%	3.6%	42	0.0%	100.0%	0.0%	0.0%
1835	224	10.7%	96.0%	0.0%	4.0%	74	12.2%	98.6%	0.0%	1.4%
1845	279	53.0%	96.8%	1.4%	1.8%	73	16.4%	97.3%	0.0%	2.7%
1855	354	50.8%	70.3%	14.4%	15.3%	162	42.0%	84.0%	0.0%	16.0%
1865	715	58.2%	48.1%	16.6%	35.2%	170	47.6%	91.2%	0.6%	8.2%
1875	1205	48.8%	54.9%	15.7%	29.4%	69	76.8%	73.9%	2.9%	23.2%
1885	1423	44.8%	53.4%	14.2%	32.4%	136	70.6%	72.1%	9.6%	18.4%
1895	2268	36.8%	45.4%	17.5%	37.1%	104	74.0%	67.3%	6.7%	26.0%
1905	2773	27.4%	40.1%	24.7%	35.2%	115	65.2%	60.9%	18.3%	20.9%
1915	2933	27.7%	39.1%	24.6%	36.2%	119	63.0%	57.1%	22.7%	20.2%
1925	2804	20.4%	42.0%	25.3%	32.7%	100	60.0%	58.0%	20.0%	22.0%

Notes: Calculated from sample which has been constructed from the sources discussed in Table 2 and the Appendix.

Table 4: Peaks and Troughs of Synchronicity between London and New York Market Returns

Years		Monthly Returns			GDP Growth			Interest Rates			Exchange Rate	
		US on NYSE	UK on LSE	Adj. R^2	US	UK	Correl	US	UK	Correl	Mean	Std. Dev
Panel A: Peaks in Integration												
1827	1837	0.11%	0.15%	0.25	4.22	2.14	0.21	5.44	3.30	-0.58	4.86	0.11
1879	1889	0.55%	0.27%	0.22	6.04	1.81	0.23	4.43	2.72	0.71	4.85	0.01
1904	1914	0.05%	0.22%	0.22	1.46	1.88	0.70	4.41	2.92	0.89	4.87	0.02
Panel B: Troughs in Integration												
1863	1874	0.55%	0.38%	-0.02	3.49	2.67	-0.01	6.33	3.12	0.10	6.60	1.26
1895	1905	0.79%	0.21%	0.02	5.04	2.11	0.41	3.98	2.41	-0.20	4.87	0.01
1908	1919	0.26%	0.41%	0.03	2.14	1.02	0.35	4.77	3.49	0.85	4.80	0.12

Notes: Peaks and Troughs in Integration chosen as cyclical highs and lows in the adjusted R^2 between returns on US securities on NYSE and UK securities on LSE. GDP Growth, interest rates and exchange rate data obtained on an annual basis from Williamson, 'U.S. GDP', Officer and Williamson, 'U.K. GDP', Officer, 'Interest Rate', and Officer, 'Exchange Rate'.

Table 5: Regressions Explaining NYSE Return using LSE UK Factors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
L1LSERf	-0.016	0.005	-0.025	-0.024	-0.085	-0.030	-0.136
	(0.080)	(0.084)	(0.081)	(0.082)	(0.091)	(0.077)	(0.102)
LSERf	0.504***	0.510***	0.500***	0.494***	0.571***	0.481***	0.459***
	(0.086)	(0.093)	(0.088)	(0.088)	(0.094)	(0.082)	(0.108)
F1LSERf	0.327***	0.340***	0.338***	0.335***	0.397***	0.311***	0.251**
	(0.080)	(0.090)	(0.083)	(0.082)	(0.089)	(0.078)	(0.104)
L1Term		-0.107					-0.003
		(0.144)					(0.139)
Term		-0.105					0.060
		(0.158)					(0.141)
F1Term		0.035					0.216*
		(0.134)					(0.128)
L1Def		-0.049					0.042
		(0.125)					(0.123)
Def		-0.076					0.065
		(0.139)					(0.123)
F1Def		0.159					0.285***
		(0.112)					(0.106)
L1SMB			0.004				-0.062
			(0.102)				(0.102)
SMB			-0.009				-0.144
			(0.100)				(0.101)
F1SMB			0.134				-0.037
			(0.101)				(0.104)
L1HML				0.049			0.122
				(0.091)			(0.093)
HML				0.143			0.126
				(0.099)			(0.103)
F1HML				0.066			0.011
				(0.097)			(0.098)
L1Rail					0.088**		0.150**
					(0.042)		(0.059)
Rail					-0.125***		-0.021
					(0.041)		(0.058)
F1Rail					-0.110***		0.033
					(0.041)		(0.060)
L1Export						-0.041	0.170
						(0.079)	(0.111)
Export						0.272***	0.288***
						(0.079)	(0.106)
F1Export						0.328***	0.425***
						(0.075)	(0.112)
Constant	0.001	0.001	0.001	0.000	0.001	0.002*	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,169	1,169	1,160	1,160	1,169	1,169	1,160
Adj-R2	0.072	0.070	0.069	0.071	0.085	0.097	0.097

Notes: The returns of the portfolios are equally weighted averages of the individual securities, including dividends and capital gains. Cross-listed securities are excluded. The dependent variable is the returns on the portfolio of US securities listed on NYSE, minus the risk-free rate. Term is the difference between the returns from short-term first class bills, and long-term British government Consols. Def is the difference between the returns on British government Consols and a portfolio of all corporate debt listed on the London Stock Exchange. LSERf is a portfolio of UK equities listed on LSE, minus the risk-free rate. Other portfolios are formed from equities on LSE based on their characteristics. SMB is the difference in returns between a portfolio of small companies minus big companies. HML is the difference in returns between a portfolio of high dividend yield companies minus low dividend yield companies. Rail is the difference in returns between railway companies and non-railway companies. Export is the difference in returns between companies in industries which could potentially export products and those in non-export industries. L1 refers to the previous month's value, and F1 refers to the next month's value.

Table 6: Comparison between New York, Brussels and Paris using LSE UK Factors

	1832 - 1925				1854 – 1925			
	NYSE	NYSE	Brussels	Brussels	NYSE	NYSE	Paris	Paris
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
L1LSERf	-0.069	-0.250*	0.036	0.005	-0.286**	-0.629***	-0.040	0.076
	(0.093)	(0.128)	(0.057)	(0.075)	(0.132)	(0.205)	(0.061)	(0.097)
LSERf	0.604***	0.517***	0.366***	0.360***	0.818***	0.588***	0.281***	0.166
	(0.100)	(0.131)	(0.061)	(0.080)	(0.143)	(0.210)	(0.070)	(0.103)
F1LSERf	0.389***	0.336***	0.083*	0.107*	0.515***	0.340	0.253***	0.244***
	(0.094)	(0.127)	(0.050)	(0.064)	(0.132)	(0.208)	(0.063)	(0.091)
L1Term		0.052		0.057		0.470		0.060
		(0.161)		(0.126)		(0.331)		(0.162)
Term		-0.016		0.080		-0.191		0.191
		(0.159)		(0.124)		(0.326)		(0.207)
F1Term		0.157		-0.146		0.264		-0.034
		(0.147)		(0.105)		(0.326)		(0.191)
L1Def		0.075		0.102		0.493		0.096
		(0.141)		(0.103)		(0.321)		(0.148)
Def		0.009		0.067		-0.094		-0.040
		(0.137)		(0.104)		(0.316)		(0.193)
F1Def		0.313***		-0.111		0.527*		-0.095
		(0.119)		(0.091)		(0.311)		(0.190)
L1SMB		-0.042		0.021		-0.227		-0.064
		(0.119)		(0.074)		(0.185)		(0.083)
SMB		-0.202*		-0.214***		-0.204		-0.190**
		(0.118)		(0.076)		(0.178)		(0.089)
F1SMB		0.008		-0.052		0.183		-0.003
		(0.121)		(0.065)		(0.189)		(0.092)
L1HML		0.116		-0.072		0.198		-0.097
		(0.111)		(0.059)		(0.158)		(0.077)
HML		0.188		0.120*		0.358**		0.076
		(0.120)		(0.068)		(0.168)		(0.085)
F1HML		-0.008		0.047		-0.129		0.128
		(0.117)		(0.065)		(0.167)		(0.087)
L1Rail		0.244***		0.060		0.172		-0.200***
		(0.091)		(0.048)		(0.158)		(0.067)
Rail		0.009		-0.067		0.050		0.062
		(0.092)		(0.048)		(0.141)		(0.069)
F1Rail		0.040		-0.015		0.104		-0.051
		(0.089)		(0.050)		(0.140)		(0.072)
L1Export		0.306*		0.087		0.554**		-0.157
		(0.160)		(0.083)		(0.252)		(0.101)
Export		0.360**		0.097		0.285		0.110
		(0.153)		(0.079)		(0.233)		(0.102)
F1Export		0.512***		0.133		0.592**		-0.103
		(0.155)		(0.089)		(0.240)		(0.100)
Constant	0.000	0.002	0.002***	0.002***	0.001	0.002	0.003***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Observations	1,089	1,089	1,089	1,089	835	835	834	834
Adj-R2	0.071	0.103	0.070	0.094	0.088	0.111	0.070	0.088

Notes: The dependent variable is the returns on the portfolio of a particular market index, minus the risk-free rate. Term is the difference between the returns from short-term first class bills, and long-term British government Consols. Def is the difference between the returns on British government Consols and a portfolio of all corporate debt listed on the London Stock Exchange. LSERf is a portfolio of UK equities listed on LSE, minus the risk-free rate. Other portfolios are formed from equities on LSE based on their characteristics. SMB is the difference in returns between a portfolio of small companies minus big companies. HML is the difference in returns between a portfolio of high dividend yield companies minus low dividend yield companies. Rail is the difference in returns between railway companies and non-railway companies. Export is the difference in returns between companies in industries which could potentially export products and those in non-export industries. L1 refers to the previous month's value, and F1 refers to the next month's value.

Table 7: Regressions Explaining NYSE Returns on Equities and Non-Equities, using LSE UK Factors

	(1) NYSE Equity	(2) NYSE NonEquity	(3) NYSE Equity	(4) NYSE NonEquity
L1LSERf	-0.065		-0.186	-0.061
	(0.089)		(0.114)	(0.089)
LSERf	0.585***		0.527***	0.231**
	(0.096)		(0.118)	(0.094)
F1LSERf	0.375***		0.311***	0.097
	(0.090)		(0.116)	(0.082)
L1Term		0.058	0.009	-0.012
		(0.088)	(0.156)	(0.100)
Term		0.275***	0.005	0.142
		(0.104)	(0.155)	(0.123)
F1Term		0.181**	0.195	0.155*
		(0.083)	(0.145)	(0.092)
L1Def		0.022	0.063	-0.014
		(0.077)	(0.138)	(0.082)
Def		0.251***	0.021	0.177*
		(0.094)	(0.136)	(0.100)
F1Def		0.219***	0.305**	0.171**
		(0.072)	(0.120)	(0.072)
L1SMB			-0.061	-0.050
			(0.114)	(0.081)
SMB			-0.188*	-0.072
			(0.112)	(0.083)
F1SMB			-0.021	-0.113
			(0.116)	(0.082)
L1HML			0.119	0.139*
			(0.104)	(0.072)
HML			0.174	0.056
			(0.114)	(0.080)
F1HML			0.023	0.001
			(0.110)	(0.075)
L1Rail			0.152**	0.159**
			(0.064)	(0.079)
Rail			-0.009	-0.102
			(0.064)	(0.074)
F1Rail			0.031	-0.050
			(0.065)	(0.068)
L1Export			0.179	0.161
			(0.123)	(0.117)
Export			0.346***	0.031
			(0.119)	(0.105)
F1Export			0.473***	0.171
			(0.124)	(0.105)
Constant	0.001	0.003***	0.001	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,169	1,004	1,160	1,004
Adj-R2	0.071	0.015	0.098	0.057

Notes: The returns of the portfolios are equally weighted averages of the individual securities, including dividends and capital gains. Cross-listed securities are excluded. The dependent variable is the returns on the portfolio of US equities or non-equities listed on NYSE, minus the risk-free rate. Term is the difference between the returns from short-term first class bills, and long-term British government Consols. Def is the difference between the returns on British government Consols and a portfolio of all corporate debt listed on the London Stock Exchange. LSERf is a portfolio of UK equities listed on LSE, minus the risk-free rate. Other portfolios are formed from equities on LSE based on their characteristics. SMB is the difference in returns between a portfolio of small companies minus big companies. HML is the difference in returns between a portfolio of high dividend yield companies minus low dividend yield companies. Rail is the difference in returns between railway companies and non-railway companies. Export is the difference in returns between companies in industries which could potentially export products and those in non-export industries. L1 refers to the previous month's value, and F1 refers to the next month's value.

Table 8: Regressions Explaining NYSE Return using LSE International Factors

	1825 – 1925			1870 – 1925				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NonUK.L1		0.059			0.054			
		(0.046)			(0.244)			
NonUK		0.037			0.714***			
		(0.048)			(0.211)			
NonUK.F1		0.040			0.408**			
		(0.043)			(0.198)			
Americas.L1			0.018			-0.109		
			(0.038)			(0.127)		
Americas			0.135***			0.861***		
			(0.042)			(0.150)		
Americas.F1			0.106***			0.480***		
			(0.040)			(0.129)		
USA.L1							0.083	-0.015
							(0.088)	(0.088)
USA							1.061***	0.833***
							(0.094)	(0.092)
USA.F1							0.271***	0.254***
							(0.085)	(0.093)
USA-Def.L1								0.125
								(0.161)
USA-Def								0.408**
								(0.169)
USA-Def.F1								0.004
								(0.175)
USA-SMB.L1								-0.059
								(0.052)
USA-SMB								-0.350***
								(0.053)
USA-SMB.F1								-0.053
								(0.052)
USA-HML.L1								0.016
								(0.041)
USA-HML								-0.071
								(0.046)
USA-HML.F1								0.010
								(0.041)
Constant	0.001	0.001	0.001	0.002	0.000	-0.001	-0.004***	-0.003**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
UK Factors	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,160	1,160	1,160	658	658	658	658	658
Adj-R2	0.097	0.097	0.107	0.132	0.154	0.214	0.343	0.420

Notes: The returns of the portfolios are equally weighted averages of the individual securities, including dividends and capital gains. Cross-listed securities are excluded. The dependent variable is the returns on the portfolio of US securities listed on NYSE, minus the risk-free rate. Other portfolios are formed from securities on LSE based on their characteristics. Regional indices are orthogonalised by regressing their portfolio returns against a portfolio of UK securities. NonUK includes companies operating in any region outside the UK. Americas includes companies operating in North or South America. USA includes companies operating in the United States. USA-SMB is the difference in returns between a portfolio of small companies minus big US companies listed on LSE. HML is the difference in returns between a portfolio of high dividend yield companies minus low dividend yield US companies listed on LSE. L1 refers to the previous month's value, and F1 refers to the next month's value. All UK factors from Table 5 are included in each regression, but not reported individually.

Table 9: Regressions Explaining NYSE Capital Gains using LSE International Factors

	1825 – 1925			1870 – 1925				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CGNonUK.L1		0.056			0.013			
		(0.048)			(0.244)			
CGNonUK		0.057			0.783***			
		(0.049)			(0.209)			
CGNonUK.F1		0.042			0.400**			
		(0.044)			(0.198)			
CGAmericas.L1			0.027			-0.117		
			(0.041)			(0.130)		
CGAmericas			0.170***			0.921***		
			(0.043)			(0.137)		
CGAmericas.F1			0.117***			0.486***		
			(0.042)			(0.128)		
CGUSA.L1							0.089	-0.004
							(0.086)	(0.087)
CGUSA							1.051***	0.824***
							(0.093)	(0.091)
CGUSA.F1							0.282***	0.260***
							(0.083)	(0.092)
CGUSA-Def.L1								0.111
								(0.160)
CGUSA-Def								0.361**
								(0.168)
CGUSA-Def.F1								0.013
								(0.175)
CGUSA-SMB.L1								-0.054
								(0.052)
CGUSA-SMB								-0.361***
								(0.054)
CGUSA-SMB.F1								-0.058
								(0.051)
CGUSA-HML.L1								0.018
								(0.041)
CGUSA-HML								-0.073
								(0.046)
CGUSA-HML.F1								-0.001
								(0.041)
Constant	0.002*	0.002	0.001	0.003**	0.002	-0.001	-0.004**	-0.003*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
UK Factors	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,160	1,160	1,160	658	658	658	658	658
Adj-R2	0.0870	0.0867	0.101	0.138	0.161	0.225	0.349	0.428

Notes: The capital gains of the portfolios are equally weighted averages of the individual securities. Cross-listed securities are excluded. The dependent variable is the capital gains on the portfolio of US securities listed on NYSE. Other portfolios are formed from securities on LSE based on their characteristics. Regional indices are orthogonalised by regressing their portfolio capital gains against a portfolio of UK securities. NonUK includes companies operating in any region outside the UK. Americas includes companies operating in North or South America. USA includes companies operating in the United States. USA-SMB is the difference in capital gains between a portfolio of small companies minus big US companies listed on LSE. HML is the difference in capital gains between a portfolio of high dividend yield companies minus low dividend yield US companies listed on LSE. L1 refers to the previous month's value, and F1 refers to the next month's value. All UK factors are included in each regression, but not reported individually.

Table 10: Price Ratios and Cointegration Tests of Cross-Listed Stocks

	Years			Price Ratio		ADF of Residual from Cointegrating Regression	Adj. R^2 of Error Correction Model	
	Start	End	Obs	Mean	St. Dev		Returns	Cap Gains
Second Bank of the United States (Shares)	1825	1841	155	0.995	0.047	-9.813	73.2%	72.0%
New York Lake Erie & Western Railroad (Common stock)	1857	1871	106	0.986	0.077	-6.724	62.3%	61.1%
Illinois Central Railroad ($100 shares)	1860	1925	569	1.001	0.014	-21.385	61.0%	60.9%
New York Central and Hudson River (7 % Bonds)	1875	1892	125	1.000	0.005	-8.445	36.7%	41.2%
Union Pacific ($100 shares)	1878	1898	169	1.001	0.043	-8.672	84.6%	84.6%
Central Pacific and California ($100 Shares)	1881	1899	170	1.002	0.046	-12.080	81.5%	81.4%
Lake Shore and Michigan Southern (Shares)	1881	1898	177	1.001	0.011	-7.699	70.6%	70.7%
Louisville & Nashville ($100 shares)	1881	1925	456	1.002	0.014	-19.889	78.4%	78.4%
Chicago Milwaukee & St. Paul (Common stock)	1883	1925	454	1.001	0.036	-13.750	69.9%	70.1%
Chicago Milwaukee & St. Paul (5 % Chic. & Pacific Western 1921)	1883	1908	160	0.998	0.004	-13.408	60.3%	58.7%
Denver and Rio Grande (Common Stock)	1883	1920	314	0.998	0.049	-16.467	79.3%	79.3%
Baltimore & Ohio (5 % gold bonds 1925)	1886	1894	61	0.997	0.003	-6.340	55.4%	54.7%
Chicago Milwaukee & St. Paul (7 % preferred stock)	1886	1925	324	1.003	0.026	-17.510	73.5%	73.4%
Chicago Milwaukee & St. Paul (5 % gold bonds)	1886	1898	67	1.000	0.005	-6.175	51.9%	50.7%
Northern Pacific (Preferred stock)	1887	1901	154	1.012	0.054	-7.064	74.0%	73.7%
Northern Pacific (Common stock)	1887	1925	237	1.006	0.032	-13.933	84.3%	84.4%
Wabash (Preferred stock)	1890	1914	242	1.001	0.066	-7.628	65.3%	65.3%
Wabash (Capital stock)	1890	1911	124	0.994	0.067	-6.466	74.0%	74.0%
Chesapeake & Ohio (Capital stock)	1891	1925	345	1.000	0.032	-15.761	77.9%	77.5%
Miss. Kan. & Tex. (Common stock)	1891	1923	255	1.010	0.111	-12.808	69.3%	69.3%
St Paul Minn. & Mani. (Capital stock)	1891	1898	67	1.003	0.009	-5.485	58.6%	58.9%
Chesapeake & Ohio (5% Gold Bonds)	1892	1924	254	1.001	0.006	-9.615	70.4%	70.1%
Chicago R. I. and Pacific (4 % Gold coup bonds)	1899	1923	128	1.002	0.009	-6.381	69.2%	69.1%
Union Pacific Rlrd. and Lnd. Gt. (4 % Bonds)	1899	1925	219	0.999	0.006	-9.925	64.2%	64.4%
Central Pacific (4 % 1st refund bonds 1945)	1900	1925	205	1.000	0.007	-8.553	69.7%	70.5%
Erie Railroad (4 % non-cum. 1st pref)	1900	1925	256	0.999	0.029	-9.167	82.2%	82.3%
Erie Railroad (4 % non-cum. 2nd pref)	1900	1925	229	1.001	0.047	-11.867	74.4%	74.6%
Northern Pacific (Prior Lien 4 % 1997)	1900	1925	214	0.999	0.007	-8.200	63.7%	64.0%
Baltimore & Ohio (Stock certs)	1902	1925	241	1.001	0.016	-12.977	77.9%	78.3%
Baltimore & Ohio (4 % non-cum. pref)	1902	1925	180	1.004	0.008	-11.844	83.4%	83.6%
Northern Pacific Gt. Northern (General lien 3 %)	1905	1925	180	1.000	0.009	-6.108	65.8%	66.1%
Rock Island Co. (Com. stock)	1905	1913	94	0.998	0.018	-9.395	93.7%	93.7%
Union Pacific Rlrd. & Land Grant (4 % non-cum. pref)	1907	1925	157	1.002	0.007	-9.091	76.4%	76.2%
Union Pacific Rlrd. & Land Grant (4 % 1st lien)	1909	1925	166	1.008	0.010	-6.355	61.5%	61.2%
Denver & Rio Grande (5 % non-cum. pref)	1911	1920	78	0.961	0.093	-4.892	80.4%	80.4%
Amer. Telep. & Telegraph (Cap stock)	1913	1925	105	1.002	0.007	-7.083	75.0%	75.2%

Notes: Each asset which was cross-listed on both NYSE and LSE simultaneously, and traded for at least 60 months, is shown. The ratio of the log of the price on NYSE to the log of the price on LSE is calculated each month, and the mean and standard deviation is reported. The log of the price in New York was also regressed against the log of the price in London, and the residuals tested using an Augmented Dickey Fuller (ADF) test. The Adjusted R^2 from an Error Correction Model is also shown which regresses the returns on NYSE against the returns on LSE, one lag and lead, and the lagged residual from the cointegrating relationship.